**REMARKS**

Claims 1 and 3 -13 are pending in the present application, claim 2 having been cancelled without prejudice or disclaimer, and claims 11-13 having been added herein. The Office Action and cited references have been considered. Favorable reconsideration is respectfully requested.

Applicant thanks the Examiner and his supervisor for the courtesies extended during the personal interview on February 12, 2009. This amendment is presented in accordance with the discussions during that interview.

Applicant note with appreciation the indication that claims 3, 4, and 7-10 contain allowable subject matter. Applicant has amended claims 3, 7, and 9, to place them in independent form, to advance prosecution, without conceding the merits of the rejection of claim 1, and has added claims 11-13 to depend from allowed claims 3, 7 and 9, respectively.

Claims 1, 2 and 6 were rejected under 35 U.S.C. §103(a) as being unpatentable over Zhang et al. (U.S. Patent Application No. 2002/0159457) in view of Steer et al. (U.S. Patent Application No. 2003/0103445) and further in view of Elstermann (U.S. Patent No. 6,771,657). Claim 5 was rejected under 35 U.S.C. §103(a) as being unpatentable over Zhang in view of Steer and Elstermann, and further in view of Ono et al. (U.S. Patent No. 6,879,768). These rejections are respectfully traversed for the following reasons.

To advance prosecution, Applicant has amended claim 1 to include the features of claim 2. Specifically, claim 1 now recites a system for the transmission of DVB/MPEG digital signals, particularly for satellite communication. The system comprises

a transmitting station in which a multiplexer (32) inserts null packets in the DVB/MPEG streams originating from one or more 5 VBR coders or generic data sources (31) so that their bit-rates are made uniform, and multiplexes them into a single transport stream that is then applied to a modulating chain for transmission over a propagation channel, and a receiving station in which a demodulating chain receives the signal being transmitted over the channel, reconstitutes the transport stream and applies it to a demultiplexer. The modulating chain in the transmitting station comprises a control circuit (72) controlling the bit-rate of the MPEG coders or generic data sources (31), a null-packet eliminator (60) for removing null packets from the transport stream received from the multiplexer (32), in order to adapt the bit- rate of the transport stream when the transport stream is transmitted by the transmitting station to the variable channel capacity, and an ACM modulator (62) downstream of the eliminator, which is programmed for coding the stream with the maximum ruggedness allowed by the rate of the incoming useful packets. The receiving station comprises an ACM demodulator (64), a null-packet re-inserter (66) for re-inserting null packets in the transport stream, and an evaluator of quality of service (68) driven by the ACM demodulator (64) for notifying the level of quality of the received signal to the bit-rate control circuit (72) of the transmitting station via a return channel. The bit-rate control circuit (72) is programmed to change the bit-rate of the VBR coder or coders or generic data sources (31) depending on the level of quality of service notified by the evaluator (68), the null-packet eliminator introduces into the transmitted signal indications of the number and position of the eliminated null packets and the null-packet

re-inserter uses said indications to restore the null packets. This is not taught, disclosed or made obvious by the prior art of record.

Applicants first provide a brief overview of the invention and how it relates to the prior art generally. This is an elaboration of what is stated more concisely in the introduction to the disclosure. The method of transmission with variable bit-rate (VBR) adaptive coding and modulation (ACM) has been developed and applied for some time to truly VBR streams, while the constant-bit-rate (CBR) nature of the MPEG Transport-Stream protocol has been obviously seen as a barrier for its transportation over an ACM link.

In fact, the rigidity of the DVB/MPEG protocol has made it impossible in the past to use the adaptive technique mentioned above. More particularly, this protocol specifies that both the chronological order and the rate of the packets be conserved at reception, and that the overall bit-rate of the transport stream be held constant, because these values are used by the receiver for restoring the program synchronization clock: this circumstance, as will be obvious for a person skilled in the art, has been regarded as irreconcilable with the change of bit-rate required for adapting the system to different conditions of transmission.

Under the MPEG protocol, single or multiple variable bit-rate sources are allowed to be multiplexed into a constant bit-rate Transport Stream – in a so called Statistical Multiplex – and when VBR source packets are not available, the Transport Stream is filled up with null-packets.

The total bit-rate of a Transport-Stream must be rigorously constant, as well as the channel end-to-end delay (if the transmitter bit-rate is constant, but the network

introduces delay variations, the resulting bit rate before the MPEG decoder becomes variable).

Methods for changing the bit-rate of a Transport Stream at the boundary between two constant bit-rate networks have been used in MPEG remultiplexers. However, the remultiplexer will generate a fresh Transport Stream, and will use packet add/drop and complex techniques for updating the PCRs. Some of these techniques are reported in Dunn, but they are not adopted in the present invention, since they are not applicable to continuous bit-rate variations such as that required in ACM transmission.

The present invention of Morello et al. is based on the recognition that under the MPEG protocol, it is not actually necessary to maintain the constant bit-rate nature of a transport-stream in the ACM channel, but it is sufficient that this constant bit-rate and constant end-to-end delay are guaranteed before the ACM modulator and after the ACM receiver. Based on this recognition, the invention combines a number of individually known, simple techniques to solve the problem of using ACM with MPEG streams, a problem which had been previously regarded as inherently contradictory. To achieve this aim, the invention combines the following techniques:

1) controlling the bit-rate of the video coding source or of the interactive data sources, rather than using a trans-rate multiplexer, as would be done conventionally,

2) generating a conventional constant bit-rate Transport Stream with a varying percentage of null-packets (the lower the source bit-rate, the higher the percentage of null-packets),

3) deleting the null-packets in the ACM transmitter, so that the rate on the channel may change as required by ACM, and

4) re-inserting null-packets at the ACM receiver, exactly in the position where they had been removed.

It can be seen that the signal in the path between the ACM transmitter and the ACM receiver is not a DVB Transport Stream, although the re-insertion of the null packets will generate a DVB Transport Stream after the demodulator that is an exact copy of the original one. According to the invention, the null packets are eliminated in ACM transmitter so that the bit-rate of the transport stream can be adapted to the variable channel capacity, the null-packet count is hidden in the transport stream so that it is not thrashed by the demultiplexer, and then the count is retrieved and used to restore the null packets in their proper places. The ACM system can then do its job of adaptive coding and modulation.

This combination is neither disclosed nor hinted in any of the prior art references and is embodied in a system for the transmission of DVB/MPEG as defined in claim 1.

Turning to the merits of the rejection, the Action relies on Zhang mainly because it shows (in Figs. 1, 4, 5, and 9) a bit-rate conversion device applicable to a single or to multiple MPEG encoded audio-video streams under the control of a rate controller (Fig. 1, block 512; Fig. 4, block 430; Fig. 5, block 512; and Fig. 9, blocks 912 and 914). However, as discussed during the interview, Zhang corresponds to that portion of Applicant's system before the multiplexer 32. There is nothing in Zhang to suggest or teach

how to make a constant bit-rate transport stream capable of being transmitted in by ACM transmitter, along a variable capacity channel.

The fact that ACM transmission, VBR video/audio coding, and null-packet insertion in a MPEG multiplexer to achieve a constant bit-rate transport stream are features that all belong to the prior art is acknowledged in the present application, *e.g.*, page 4, lines 23 *et seq.*, referring to Fig. 2, which states:

> The system of Figure 1 is shown in more detail in Figure 2. The transmitting station 10 comprises a plurality of sources 30 of audio/video signals, driving respective MPEG coders 31 at a variable bit-rate (VBR). The streams of DVB/MPEG packets generated by coders 31 are applied to respective inputs of a multiplexer 32, which inserts null packets within the individual streams, in a way known per se, to the extent necessary to produce a constant bit-rate, before multiplexing the individual streams into a single transport stream TS, which is then applied to a modulating chain . . .

Elstermann discloses to extract null packets from a transport stream, to record the number of extracted null packets in an annotation packet, and to re-insert the null packets after transmission. However, the packets recovered from the transport stream are stored before regenerating a stream with null packets as indicated in the annotation packet. *See*, col. 2, lines 31 *et seq*. Elstermann discloses two distinct logical processes:

Process 1. In Fig. 1, block 140, a real time MPEG transport stream, coming from input (a), is analyzed, and new non-real-time 188-byte data packets are inserted from input (d) replacing original null-packets of the real-time stream. The stream on the channel ***remains a true transport stream (with an un-modified, constant bit-rate)***,

while the considered channel is constant modulation and coding, thus with a constant end-to-end delay time.

A non-real time transport stream coming from the input (a) or (c) is "condensed", by means of a process 130 that eliminates null-packets or nonessential packets and ***replaces them*** by notification packets. This "condensed" non-real-time stream provides the data-packet input (d) feeding the previous process (1). Program player 230 in the receiver provides the inverse processing and re-constructs the original non-real-time transport stream in the receiver (fig. 2). Applicant respectfully submits that the "condensed" non-real-time packet-stream travelling on the transmit channel is no longer an MPEG-compliant transport stream, because it cannot be directly decoded by an MPEG audio-video decoder, without being stored and processed by the program player 230 in the received, Fig. 2).

In other words, Elstermann's process 1. starts with a conventional constant bit-rate transport stream, and generates a constant bit-rate transport stream, ***with an additional non-real-time payload in place of the null packets***. As noted by the Examiner, there is no ACM system disclosed by Elstermann. Block 295 (content provider control) in Fig. 2 is not an ACM control signal from the receiver to the transmitter. As explained in col. 5, lines 23-38 of Elstermann, in the case of advertisements delivered as MPEG-2 programs, the content provider may want to specify which advertisements are stored and viewed, based on the attributes of the data stream player (*e.g.*, location of the player 200, user preferences, user demographics, etc.). A content provider control function 295 may be used to communicate with the content provider for this purpose.

Process 2. The process carried out in blocks 120, 125, and 130, of Fig. 1 reduces the bits in a transport stream by extracting null-packets and nonessential packets. However, this is done in preparation to storage in a storage device 132. When the condensed stream is read from the storage for playback, the stream is re-expanded before conveying it to the MPEG audio-video decoder. Condensing a transport stream as shown in Fig. 1 and Fig. 4 by replacing TS null packets with 188-byte "annotation packets" is similar to what is described by Ono, although the details are different: Ono appends an annotation byte to each TS packet, while Elstermann appends one annotation packet (188 bytes) every 174 TS packets.

Although Elstermann (process 2) strips off null packets from the transport stream to reduce the volume of data stored in a storage device such as a hard disk, it does not do so adaptively. Elstermann deals with non-real-time audio/video streams having a recorder/ storage media before the player/decoder. This latter is running at a constant bit-rate, which, however, is only appropriately equal to the bit-rate of the original transport stream; in fact, slight variations in the bit rate are tolerated in the player/decoder, though they would not be tolerated by a multiplexer.

Further, Elstermann (process 2) is similar to Ono, since it discloses a mechanism for null-packet deletion before recording an MPEG transport stream, and for re-introduction during play-back before MPEG decoding. As in the case of Ono, the mechanism of Elstermann is intended to save storage capacity while recording a constant bit-rate program, and, in contrast to the present claimed invention, it operates in an environment that is not changeable, but rather is under full control of the operator.

In other words, due to the intermediate storage, Elstermann does not need to comply with the rule of constant bit-rate and even less with the constant end-to-end transmission delay. No ACM bit rate conversion, nor delay jitter problems are encountered. Consequently, a designer who would try to combine the teachings of Elstermann in a system according to Zhang, might possibly obtain a system capable of Elstermann delivering to the channel a global MPEG-compliant transport stream, ***at a constant bit rate***, carrying two components:

i. one or more real-time VBR audio/video streams, directly decodable by an MPEG audio/video decoder; and

ii. one or more non-real-time audio/video condensed streams (to be considered as an additional data stream in the MPEG transport stream), suitable for recording/playback at the receiver only after Elstermann program player processing.

However, such a global transport stream delivered to the channel at a constant bit-rate, would not be suitable to be coupled with an ACM modulator.

Steer relates to mobile telephone communications, and uses a completely different scheme based on orthogonal signals. One of ordinary skill in the art would not have been motivated to look to the cell phone arts to solve problems of how to make a constant bit-rate transport stream capable of being transmitted over a variable bit-rate channel. Thus, the proposed combination of the teachings of Zhang, Elstermann and Steer would not have been obvious to one of ordinary skill in the art.

For at least these reasons, Applicant respectfully submits that claim 1 is patentable over the prior art of record whether taken alone or in combination as proposed

in the Office Action. Claims 5 and 6 depend from and include the limitations of claim 1, and are believed to be patentable at least for the reasons discussed above with respect to claim 1.

In view of the above amendment and remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections of record. Applicants submit that the application is in condition for allowance and early notice to the effect is most earnestly solicited.

If the Examiner has any questions, he is invited to contact the undersigned at 202-628-5197. Additionally, if the Examiner is inclined to maintain the rejection, he is requested to contact the undersigned to schedule an interview to advance prosecution.

Respectfully submitted,

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